

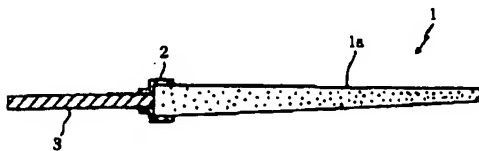
Reference No. 12 for JP patent laid-open application No. 07-198950

OPTICAL SCATTERING MATERIAL

5

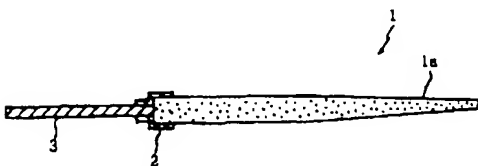
DRAWINGS

[Drawing 1]

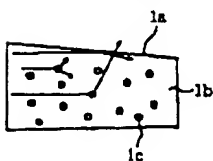


10

[Drawing 2]

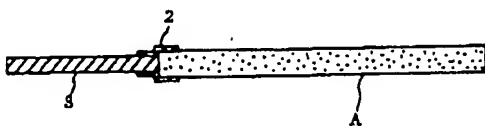


[Drawing 3]



15

[Drawing 4]



ABSTRACT:

20 PURPOSE: To uniformly scatter light transmitted through an optical transmission tube or the like as much as possible for the whole length of the scattering body and to obtain uniform luminance.

CONSTITUTION: The optical scattering material is a
25 cy lindrical body comprising a transparent matrix and a

transparent material uniformly dispersed in the matrix. The transparent material dispersed has different refractive index from that of the matrix. Light is made to enter through the one end of the body in the longitudinal direction and emitted through the whole surface of the body. This cylindrical body is formed as gradually tapered from the one end of length or from near the center of the length the other end.

10 CLAIMS

[Claim(s)]

[Claim 1] While the transparent material from which this matrix and a refractive index differ consists of a pillar-shaped object distributed uniformly and incidence of the light is carried out from the length direction end section into a transparent matrix The light-scattering object characterized by being formed so that the above-mentioned pillar-shaped object may be missing from the length direction other end from the length direction end section or the length direction simultaneously center section and may become a taper gradually in the light-scattering object to which outgoing radiation of this light is carried out from all periphery sides.

[Detailed Description of the Invention]

[0001]

[Industrial Application] this invention is used as a scatterer scattered about in the light which connected at noses of cam, such as an optical-transmission tube, and was transmitted by the optical-transmission tube etc., and relates to the light-scattering object used suitable for the use of decorative illumination, underwater lighting, explosion-proof lighting, a display, etc.

[0002]

[Description of the Prior Art] Conventionally, a light-scattering object is connected at the nose of cam of an optical-transmission tube or an optical fiber at joint, the light from these tubes and fibers is transmitted to a light-scattering object, the lighting to which

outgoing radiation of the light which carried out incidence to this light-scattering object is carried out from an optical scatterer all periphery side is known, and this has various uses, such as decorative illumination, underwater lighting, explosion-proof lighting, a display, and special lighting.

5 [0003] Here, the light-scattering object consists of material which distributed uniformly the transparent material from which this and a refractive index differ in a transparent matrix, and distributed true spherical silicone resin in the polymethacrylate, and makes such a material the shape of a rod, a globular shape, a multiple configuration, a tabular, etc.

10 [0004] Although the transparent matrix itself transmits light without the total reflection of light happening by the interface with air and leaking light outside, such a light-scattering object In case light advances the inside of a matrix, light is scattered about into this matrix by the interface with the transparent material by which uniform distribution was carried out, the degree component of angle of elevation with which an angle with the
15 interface of a transparent matrix and air does not fill total reflection conditions is made, this light carries out outgoing radiation from a peripheral surface, and light comes from the whole light-scattering object.

[0005] However, brightness falls as the distance from the light source of optical-transmission tube 3 grade connected at joint 2 becomes far, when it considers as the
20 pillar-shaped object A as showed the light-scattering object to drawing 4 , and there is a problem that dispersion becomes uneven.

[0006] For this reason, although making it increase as the irregularity over which light is scattered as the distance from the light source becomes long is prepared or the distance from the light source becomes long about the material to distribute, and attaining
25 equalization of scattered-light intensity was performed, the homogeneity of dispersion and directivity were inadequate.

[0007] this invention was made in view of the above-mentioned situation, and aims at dispersion of light offering a uniform pillar-shaped light-scattering object as much as possible to the distance from the light source.

30 [0008]

[Means for Solving the Problem and its Function] While this invention consists of a

pillar-shaped object with which the transparent material from which this matrix and a refractive index differ in a transparent matrix was uniformly distributed in order to attain the above-mentioned purpose and incidence of the light is carried out from the length direction end section In the light-scattering object to which outgoing radiation of this light is carried out from all periphery sides, the light-scattering object characterized by being formed so that the above-mentioned pillar-shaped object may be missing from the length direction other end from the length direction end section or the length direction simultaneously center section and may become a taper gradually is offered.

[0009]

[Function] Although outgoing radiation of the light which the light-scattering object of this invention is a pillar-shaped object, the optical-transmission tube, the optical fiber, etc. were connected with the end section (light source), and light was scattered by the transparent material distributed in the transparent matrix in the light transmitted from now on, and carried out incidence is carried out from all periphery sides Since it formed so that a pillar-shaped object might be covered over the length direction other end from the length direction end section or the length direction simultaneously center section and it might become a taper gradually In order that the superficies of a pillar-shaped object may ***** the bottom gradually to the length direction in a drawer back and the cross section may decrease from the center section mostly at least, A fixed rate in this inclined plane among the light which advances in parallel with the length direction of this pillar-shaped object Put [reflection or / appearance], Furthermore, the optical component which serves as an obtuse angle by the time of on the other hand reflecting by the side, and becomes [a component] easy to carry out outgoing radiation, therefore carries out total reflection on the front face of a pillar-shaped object can decrease, and the reflected light can be more mostly scattered outside in the portion which gave this inclination. And the scattered light can be made to increase at a fixed rate according to the degree of tilt angle, the fall of the brightness in the portion which is certainly [simply and] separated from the light source can be prevented, and the brightness in the overall length of a light-scattering object can be equalized as much as possible.

[0010]

[Example] Hereafter, when the example of this invention is explained concretely, drawing 1 and 2 are what shows one example of the light-scattering object of this invention. the light-scattering object 1 of drawing 1 It is the pillar-like object which has inclined plane 1a which was missing from the other end from the end section, and was gradually formed in tapering off. the light-scattering object 1 of drawing 2 It is the pillar-like object which has inclined plane 1a which was missing from the other end from the length direction simultaneously pars intermedia, and was gradually formed in tapering off, and the end section (overall diameter portion) is connected with the optical-transmission tube 3 (light source) at joint 2.

[0011] In this case, any, such as circular, an ellipse form, a polygon, a rectangle, and a sheet metal form, are sufficient as the cross-section configuration of the light-scattering object 1. Although length is selected suitably, generally the range of 2, especially 1.5-20cm has 3-100cm and the greatest cross section especially common [moreover,] by the side of 5-50cm the range and the end section 0.05-100cm. Although further selected suitably by the length of a light-scattering object etc., as for the rate gradually made tapering off, it is good the matrix which constitutes a light-scattering object, a transparent material, and to form in tapering off gradually the 10 - 100% of the length directions, so that the cross section may finally carry out a phenomenon 15 to 80% preferably. In addition, like drawing 2 , when making it tapering off gradually from the pars intermedia of a light-scattering object, the thing of the end section (light source) of a light-scattering object to an overall length for which the part which starts tapering off is preferably made into 20 - 50% of range 1 to 80% is good.

[0012] It sets into the material which constitutes the light-scattering object 1 of this invention. as transparent matrix 1b in drawing 3 Organic system resins, such as a polymethylmethacrylate, a polycarbonate, silicone, and polystyrene, As transparent-material 1c which can use inorganic system material, such as glass, a quartz, and a transparent ceramic, and is distributed by this Organic system fine particles, such as a polymethylmethacrylate, a polycarbonate, polystyrene, and silicone resin, A calcium carbonate, titanium oxide, glass, a silica, and a single crystal can also consist of inorganic system fine particles, such as a transparent ceramic powder, and also gas, a foam, a vacuum void, etc., the true spherical of a configuration is desirable, and especially the

mean particle diameter has desirable about 0.1-10 micrometers 0.01-50 micrometers. the variance of a transparent material -- 0.001 - 50 weight section -- 0.005 - 1 weight section is preferably common If a desirable example is shown concretely, what carried out 0.005-0.5 weight section combination of the powder, such as a calcium carbonate of 0.5-20 micrometers of mean particle diameters, titanium oxide, and glass, can be illustrated in the thing, the polymethylmethacrylate, or the polycarbonate 100 weight section which blended the 0.005 - 0.5 weight section with the transparent matrix 100 weight section of a polymethylmethacrylate for true spherical silicone resin of 0.1-10 micrometers of mean particle diameters.

[0013] When manufacturing the light-scattering object of this invention, after kneading the powder used as a transparent matrix and a transparent material, How to fabricate in a predetermined configuration by extrusion molding, injection molding, compression molding, casting, etc., Or when a matrix is an organic system resin, after mixing the fine particles which become a polymerization nature monomer with a transparent material, After carrying out a polymerization with polymerization methods, such as a bulk polymerization, and carrying out a polymerization to the form of a direct predetermined configuration or obtaining a polymer in the form of fine particles with polymerization methods, such as a suspension polymerization, the method of fabricating this and making it into a predetermined form etc. can be illustrated.

[0014] As an example of use of the light-scattering object of this invention, a rise lamp, a room lamp, The various lighting of a ceiling automatic in the car [, such as a reading LGT,], the lighting in a trunk room; the lighting of meter, The lighting in dashboards, such as lighting of various switches, the lighting of a glove box or an ash pan, The various lighting of making the lighting of a keyhole, the lighting of a number plate, the back light of a number plate, the lighting of various emblems, point luminescence of the antenna pole, the corner pole, and a bumper mall emit light to a line etc. and/or the use as an emitter are mentioned. In this case, the scattered light can be obtained by carrying out incidence of the light from the established light sources, such as the light source of the exclusive use arranged in the car, a head lamp, and a side marker lamp.

[0015] Moreover, it can also be used for frames, such as a shining hanger which is used for the back light of an advertising LGT, a signboard, the shining wall, a ceiling, and OA

equipment etc. as a flat-surface object other than the above-mentioned use in a closet etc., a balustrade, and a bicycle, a table lamp, etc. as a rod-like structure. Furthermore, it can also be used for uses, such as sterilization of water, such as lighting for cultivation, such as a biotechnology tub, a pond, a pool, and purification plant, and purification, by also
5 being able to use it as line markers, such as a marine hose, a guidance line for emergencies, a yard display of a golf course, and a pool, a line display of a truck, and scattering ultraviolet rays.

[0016]

[Effect of the Invention] The light-scattering object of this invention covers an overall
10 length in the light transmitted from the optical-transmission tube etc., are scattered about uniformly as much as possible, and brightness is equalized:

TECHNICAL FIELD

[Industrial Application] this invention is used as a scatterer scattered about in the light
15 which connected at noses of cam, such as an optical-transmission tube, and was transmitted by the optical-transmission tube etc., and relates to the light-scattering object used suitable for the use of decorative illumination, underwater lighting, explosion-proof lighting, a display, etc.

20 EFFECT OF THE INVENTION

[Effect of the Invention] The light-scattering object of this invention covers an overall length in the light transmitted from the optical-transmission tube etc., are scattered about uniformly as much as possible, and brightness is equalized.

25 OPERATION

[Means for Solving the Problem and its Function] In order that this invention may attain the above-mentioned purpose, while consisting of a pillar-shaped object with which the transparent material from which this matrix and a refractive index differ in a transparent matrix was distributed uniformly and carrying out incidence of the light from the length
30 direction end section In the light-scattering object to which outgoing radiation of this light is carried out from all periphery sides, the light-scattering object characterized by

being formed so that the above-mentioned pillar-shaped object may be missing from the length direction other end from the length direction end section or the length direction simultaneously center section and may become a taper gradually is offered.

5 DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is the cross section showing an example of the light-scattering object of this invention.

[Drawing 2] It is the cross section showing other examples of the light-scattering object of this invention.

[Drawing 3] It is the fragmentary sectional view showing signs that the light which carried out incidence in the optical scatterer is scattered about.

[Drawing 4] It is the cross section showing the conventional light-scattering object.

[Description of Notations]

15 1 Light-Scattering Object

1a Inclined plane

1b Transparent matrix

1c Transparent material

2 Joint

20 3 Optical-Transmission Tube

(12)

(19) 日本国特許庁 (J P)

(12) 公開特許公報 (A)

(11) 特許出願公開番号

特開平7-198950

(43) 公開日 平成7年(1995) 8月1日

(51) Int.Cl. ⁶	識別記号	庁内整理番号	F I	技術表示箇所
G 0 2 B 6/00	3 0 1	3 3 1		

審査請求 未請求 請求項の数 1 F D (全 4 頁)

(21) 出願番号 特願平5-354591

(22) 出願日 平成5年(1993)12月28日

(71) 出願人 591061046
小池 康博
神奈川県横浜市青葉区市ヶ尾町534の23
(71) 出願人 000005278
株式会社ブリヂストン
東京都中央区京橋1丁目10番1号
(72) 発明者 小池 康博
神奈川県横浜市緑区市ヶ尾町534-23
(72) 発明者 杉町 正登
東京都小平市小川東町3-5-5
(72) 発明者 石原田 稔
東京都小平市小川東町3-4-4-307
(74) 代理人 弁理士 小島 隆司

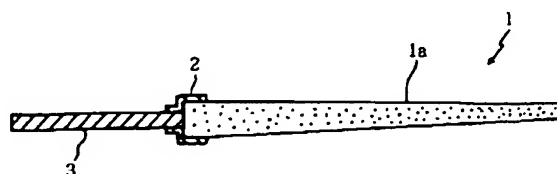
最終頁に続く

(54) 【発明の名称】 光散乱体

(57) 【要約】

【構成】 透明マトリックス中にこのマトリックスと屈折率の異なる透明材料が均一に分散された柱状体からなり、その長さ方向一端部から光が入射されると共に、この光を全外周面から出射させる光散乱体において、上記柱状体が、その長さ方向一端部乃至長さ方向ほぼ中央部から長さ方向他端部にかけて漸次先細になるように形成されたことを特徴とする光散乱体 (1)。

【効果】 本発明の光散乱体は、光伝送チューブ等から伝送された光を全長に亘り可及的に均一に散乱して輝度が均一化されるものである。



【特許請求の範囲】

【請求項 1】 透明マトリックス中にこのマトリックスと屈折率の異なる透明材料が均一に分散された柱状体からなり、その長さ方向一端部から光が入射されると共に、この光を全外周面から出射させる光散乱体において、上記柱状体が、その長さ方向一端部乃至長さ方向ほぼ中央部から長さ方向他端部にかけて漸次先細になるように形成されたことを特徴とする光散乱体。

【発明の詳細な説明】**【0001】**

【産業上の利用分野】 本発明は、光伝送チューブ等の先端に連結して光伝送チューブ等で伝送された光を散乱する散乱体として使用され、装飾照明、水中照明、防爆照明、ディスプレイ等の用途に好適に用いられる光散乱体に関する。

【0002】

【従来の技術及び発明が解決しようとする課題】 従来より、光伝送チューブや光ファイバーの先端に光散乱体をジョイントで接続し、これらのチューブやファイバーからの光を光散乱体に伝送し、この光散乱体に入射した光を光散乱体全外周面から出射させる照明方法が知られており、これは装飾照明、水中照明、防爆照明、ディスプレイ、特殊照明等の広い用途がある。

【0003】 ここで、光散乱体は、透明マトリックス中にこれと屈折率が異なる透明材料を均一に分散させたもので、例えばポリメタクリレート中に真球状シリコーン樹脂を分散させた材料で構成されており、このような材料をロッド状、球状、多面形状、板状等としたものである。

【0004】 このような光散乱体は、透明マトリックス自体は空気との界面で光の全反射が起こり、外部に光を漏らさないで光を伝送するものであるが、光がマトリックス中を進行する際に、このマトリックス中に均一分散された透明材料との界面で光が散乱し、透明マトリックスと空気との界面との角度が全反射条件を満たさない高角度成分ができ、この光が周面から出射して、光散乱体全体から光が出るものである。

【0005】 しかしながら、光散乱体を図 4 に示したような柱状体 A とした場合、ジョイント 2 で連結された光伝送チューブ 3 等の光源からの距離が遠くなるに従い輝度が下がり、散乱が不均一になるという問題がある。

【0006】 このため光源からの距離が長くなるに従い光を散乱させる凹凸を設けたり、分散させる材料を光源からの距離が長くなるに従い増加させ、散乱光強度の均一化を図ることが行われているが、散乱の均一性、方向性は不十分であった。

【0007】 本発明は、上記事情に鑑みなされたもので、光源からの距離に対して光の散乱が可及的に均一である柱状の光散乱体を提供することを目的とする。

【0008】

【課題を解決するための手段及び作用】 本発明は、上記目的を達成するため、透明マトリックス中にこのマトリックスと屈折率の異なる透明材料が均一に分散された柱状体からなり、その長さ方向一端部から光が入射されると共に、この光を全外周面から出射させる光散乱体において、上記柱状体が、その長さ方向一端部乃至長さ方向ほぼ中央部から長さ方向他端部にかけて漸次先細になるように形成されたことを特徴とする光散乱体を提供する。

10 【0009】

【作用】 本発明の光散乱体は、柱状体で、その一端部に光伝送チューブや光ファイバーなど（光源）を連結して、これから伝送された光を透明マトリックス中に分散された透明材料で光を散乱させ、入射した光を全外周面から出射させるものであるが、柱状体をその長さ方向一端部乃至長さ方向ほぼ中央部から長さ方向他端部にかけて漸次先細になるように形成したので、少なくともほぼ中央部より先側において柱状体の外面が長さ方向に対し漸次下向傾斜し、断面積が減少していくため、この柱状体の長さ方向に平行に進行する光のうち一定の割合がこの傾斜面で反射又は出射し、更に反射した光は他面側で反射する際により鈍角となって出射し易くなり、従って、柱状体の表面で全反射する光成分が減少し、この傾斜を持たせた部分でより多く外部に散乱させることができる。しかも傾斜角度に応じて一定の割合で散乱光を増加させることができ、簡単に確実に光源から離れた部分での輝度の低下を防止して光散乱体の全長における輝度を可及的に均一化することができる。

【0010】

30 【実施例】 以下、本発明の実施例について具体的に説明すると、図 1、2 は本発明の光散乱体の一実施例を示すもので、図 1 の光散乱体 1 は、一端部から他端部にかけて漸次先細りに形成された傾斜面 1 a を有する円柱状体であり、図 2 の光散乱体 1 は、長さ方向ほぼ中間部から他端部にかけて漸次先細りに形成された傾斜面 1 a を有する円柱状体であり、その一端部（最大径部分）がジョイント 2 で光伝送チューブ 3（光源）と連結されている。

40 【0011】 この場合、光散乱体 1 の断面形状は、円形、楕円形、多角形、長方形、薄板形等いずれでも良い。また、長さは適宜選定されるが、一般に 3～100 cm、特に 5～50 cm の範囲、一端部側の最大の断面積が 0.05～100 cm²、特に 1.5～20 cm² の範囲が一般的である。漸次先細りにする割合は光散乱体を構成するマトリックスや透明材料、更には光散乱体の長さ等によって適宜選定されるが、長さ方向 10～100%、好ましくは 15～80% 断面積が最終的に現象するように漸次先細りに形成することが良い。なお、図 2 のように、光散乱体の中間部から漸次先細りにする場合、先細りを開始する箇所は光散乱体の一端部（光源）

から全長の1〜80%、好ましくは20〜50%の範囲とすることが良い。

【0012】本発明の光散乱体1を構成する材料において、例えば図3中の透明マトリックス1bとしては、ポリメチルメタクリレート、ポリカーボネート、シリコン、ポリスチレン等の有機系樹脂、ガラス、石英、透明セラミック等の無機系材料を用いることができ、また、これに分散される透明材料1cとしては、ポリメチルメタクリレート、ポリカーボネート、ポリスチレン、シリコン樹脂等の有機系粉体、炭酸カルシウム、酸化チタン、ガラス、シリカ、単結晶が透明なセラミック粉体等の無機系粉体、更にはガス、気泡、真空ボイド等で構成することもでき、形状は真球状が好ましく、その平均粒径は0.01〜50 μ m、特に0.1〜10 μ m程度が好ましい。透明材料の分散量は、0.001〜50重量部、好ましくは0.005〜1重量部が一般的である。具体的に好ましい例を示すと、ポリメチルメタクリレートの透明マトリックス100重量部に平均粒径0.1〜10 μ mの真球状シリコン樹脂を0.005〜0.5重量部を配合したもの、ポリメチルメタクリレート又はポリカーボネート100重量部に平均粒径0.5〜20 μ mの炭酸カルシウム、酸化チタン、ガラス等の粉末を0.005〜0.5重量部配合したものなどを例示することができる。

【0013】本発明の光散乱体を製造する場合、透明マトリックスと透明材料となる粉末を混練した後、押出成形、射出成形、圧縮成形、注型等により所定の形状に成形する方法、あるいはマトリックスが有機系樹脂の場合、重合性モノマーに透明材料となる粉体を混合した後、塊状重合等の重合方法で重合して直接所定の形状の形に重合するか、あるいは懸濁重合等の重合方法により粉体の形で重合体を得た後、これを成形して所定の形にする方法を例示することができる。

【0014】本発明の光散乱体の使用例としては、アンプランプ、ルームランプ、読書灯等の自動車内の天井の各種照明、トランクルーム内の照明、メーター類の照明、各種スイッチの照明等のダッシュボードにおける照

明、グローブボックスや灰皿の照明、鍵穴の照明、ナンバープレート照明、ナンバープレートのバックライト、各種エンブレムの照明、アンテナボールの先端部発光、コーナーボールやバンパーモールを線状に発光させるなどの各種照明及び／又は発光体としての用途が挙げられる。この場合、車内に配置された専用の光源、ヘッドランプ、車幅灯等の既設の光源から光を入射することにより散乱光を得ることができる。

【0015】また、上記用途の他に広告灯、看板、光る壁、天井、OA機器のバックライト等に平面体として、クロゼット等で用いる光るハンガー、手すり、自転車等のフレーム、電気スタンドなどに棒状体として使用することもできる。更に、マリンホース、非常用誘導ライン、ゴルフ場のヤード表示、プールやトラックのライン表示などのラインマーカーとして使用することもでき、また、紫外線を散乱させることで、パイオ槽などの培養用照明、池、プール、浄水場などの水の殺菌、浄化等の用途に使用することもできる。

【0016】

【発明の効果】本発明の光散乱体は、光伝送チューブ等から伝送された光を全長に亘り可及的に均一に散乱して輝度が均一化されるものである。

【図面の簡単な説明】

【図1】本発明の光散乱体の一例を示す断面図である。

【図2】本発明の光散乱体の他の例を示す断面図である。

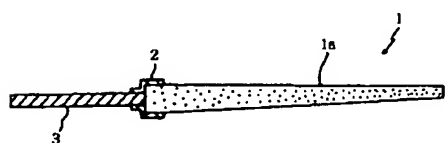
【図3】光散乱体中で入射した光が散乱する様子を示す部分断面図である。

【図4】従来の光散乱体を示す断面図である。

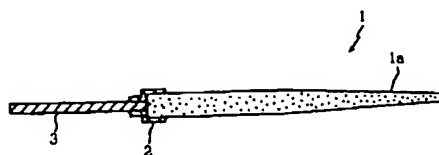
【符号の説明】

- 1 光散乱体
- 1a 傾斜面
- 1b 透明マトリックス
- 1c 透明材料
- 2 ジョイント
- 3 光伝送チューブ

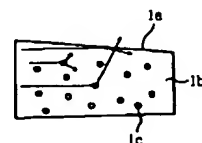
【図1】



【図2】



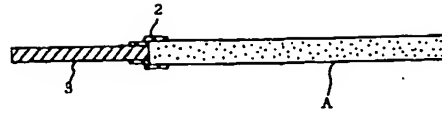
【図3】



(4)

特開平7-198950

【図4】



フロントページの続き

(72)発明者 田沼 逸夫
埼玉県狭山市柏原3405-181

(72)発明者 内藤 壽夫
神奈川県川崎市宮前区馬絹969-1

**This Page is Inserted by IFW Indexing and Scanning
Operations and is not part of the Official Record**

BEST AVAILABLE IMAGES

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images include but are not limited to the items checked:

- ☐ **BLACK BORDERS**
- ☐ **IMAGE CUT OFF AT TOP, BOTTOM OR SIDES**
- ☐ **FADED TEXT OR DRAWING**
- ☐ **BLURRED OR ILLEGIBLE TEXT OR DRAWING**
- ☐ **SKEWED/SLANTED IMAGES**
- ☐ **COLOR OR BLACK AND WHITE PHOTOGRAPHS**
- ☐ **GRAY SCALE DOCUMENTS**
- ☐ **LINES OR MARKS ON ORIGINAL DOCUMENT**
- ☐ **REFERENCE(S) OR EXHIBIT(S) SUBMITTED ARE POOR QUALITY**
- ☐ **OTHER:** _____

IMAGES ARE BEST AVAILABLE COPY.

As rescanning these documents will not correct the image problems checked, please do not report these problems to the IFW Image Problem Mailbox.